

**House Committee on Energy and Commerce
Subcommittee on Energy and Environment**

**Hearing on
“Renewable Energy:
Complementary Policies for Climate Legislation”**

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Written Testimony of
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Mr. Chairman and members of the Committee, I am Edward Lowe, General Manager for Renewables Market Development at GE Energy Infrastructure. I appreciate the opportunity to testify on the potential impacts of a Federal Renewable Electricity Standard (RES), particularly regarding new job creation. GE believes that a Federal RES is the single most important step that Congress can take to lay the long-term foundation for a “green-collar” workforce and a domestic renewable energy manufacturing base. GE also believes that adoption of a Federal RES is absolutely essential for the United States to maintain a leadership position in the global renewable energy industry. Finally, GE believes that a Federal RES is an excellent example of the “complementary” policies that are needed to address climate change by accelerating the near-term deployment of commercially available technologies to reduce greenhouse gas emissions. I acknowledge Chairman Markey for his leadership on this important national issue.

GE Energy Infrastructure is a technology leader with more than 100 years of industry experience. Our global team of 65,000 employees operates in more than 140 countries. GE Energy’s businesses offer a diverse portfolio of products and services including fossil power generation, gasification, nuclear, oil & gas, water, transmission, smart meters, and renewable energy technologies such as wind, solar, and biomass. GE is a relative newcomer to renewable energy, having entered the wind business in 2002 and the solar business in 2004. But Renewables have quickly become an important contributor to our

Energy Infrastructure business and one of the most exciting growth stories at GE.

Renewable energy in the US

The record-setting growth of renewable energy has been one of the bright spots of the US economy. According to the American Wind Energy Association (AWEA), the US installed 8,358 MW of wind power in 2008, setting another record for annual growth. This growth increased installed wind capacity by 50 percent to 25,170 MW, enough to power 7 million households, and stimulated \$17 billion of investment in the economy.¹ The US is now the global leader in wind power, having surpassed Germany last year in both wind energy generation and wind installed capacity.

In 2008, wind accounted for 42 percent of all new US nameplate installed capacity, second only to natural gas at 46 percent. AWEA estimates that the wind industry employs over 85,000 people directly and indirectly, with 13,000 manufacturing jobs created in 2008 alone. When one includes the induced economic effect of new workers spending money on goods and services, the number of wind-supported jobs approaches 185,000.²

Solar power is also experiencing record growth in the US. According to the Solar Energy Industries Association (SEIA), the growth of solar photovoltaics (PV) doubled in 2008, with approximately 600 MW installed. SEIA estimates that the solar industry (which includes solar PV, concentrated solar thermal, and solar water heater technologies) directly or indirectly employs over 80,000 people in direct and indirect jobs, with 15,000 jobs added in the last two years.³ The total number of solar-supported jobs is close to 150,000.⁴

¹ American Wind Energy Association (AWEA), "Wind Energy Grows By Record 8,300 MW in 2008," press release, 27 January 2009.

² Estimate is based on Navigant Consulting analysis prepared for AWEA, November 2008, which uses US Department of Energy (US DOE) Jobs and Economic Development Impact (JEDI) model.

³ AWEA/Solar Electric Industries Association (SEIA), "Solar and Wind Ready to Lead New Clean Energy Economy," press release, 9 January 2009.

⁴ Estimate is based on Navigant Consulting, *Economic Impacts of Extending Federal Solar Credits*, 15 September 2008. Report uses US DOE Jobs and Economic Development Impact (JEDI) model.

Renewable energy at GE

GE's renewable energy business has grown dramatically to keep up with growing US and global demand. Since entering the industry in 2002, GE has invested over \$850 million in renewable energy technology and production. Today GE's Renewables business has an installed base of over 25 GW in more than 65 countries; employs over 4,700 people globally; and has created over 10,000 sub-supplier jobs.

Leading GE's growth in Renewables has been its investment and expansion in wind. Since 2002, our investments in technology have increased the reliability of our wind turbines by 12 points, from 85 to 97 percent, and improved their efficiency by 9 points, from 39 to 48 percent. We continue to make advances in areas such as blade and tower design. We have also invested in technology leadership in grid integration capabilities, such as low-voltage ride-through and reactive power control, to facilitate the reliable operation of wind power plants. Accompanying these investments in technology has been a substantial scaling up of our manufacturing and supply chain. We have tripled the number of US assembly facilities and increased wind turbine production six-fold, ramping our production rate from 10 per week to 13 per day.

As a result of these investments, over 10,000 of our 1.5-megawatt wind turbines have been installed worldwide. GE is the leading wind turbine supplier in North America, and nearly one out of every two wind turbines installed in the US is a GE turbine. We are investing in and positioning our solar and biogas businesses to achieve similar growth.

Our business growth has translated into new GE jobs—well-paid jobs requiring technical skills and training. In the US, we employ more than 2,000 people in our Wind and Solar businesses. These include wind turbine manufacturing jobs in Pensacola, Florida; Greenville, South Carolina; Salem, Virginia; Erie, Pennsylvania; and Tehachapi, California. They include solar manufacturing and professional jobs in Newark, Delaware and Golden, Colorado. And they include professional jobs at our headquarters in Schenectady, New York, where since 2007 we have added over 300 jobs in Engineering, Project Management, and Services to support our Wind and Solar businesses.

The growth of our installed base, meanwhile, has spurred unprecedented demand for skilled workers who can operate and maintain wind projects. GE's US wind installed base already supports 1,000 operations-related jobs annually.⁵ These are long-term jobs, lasting the full life of a wind farm. The need for these workers is so strong that GE has developed training programs with several community colleges to ensure there is a trained workforce to operate and maintain our turbines when they come on-line.

Finally, our business growth is rippling through our US supply chain. When GE testified before the Congress in March 2008, we reported that our Wind business supported 2,000 jobs in 15 states. In just one year, our US supplier jobs have doubled to over 4,000. These suppliers manufacture a variety of wind components and subcomponents, including blades, towers, bedplates, nacelles, gearboxes, generators, bearings, castings, and cables.

In 2007, GE announced that two blade manufacturing companies would build new facilities in Aberdeen, South Dakota and Newton, Iowa to supply GE wind turbines, adding 1,250 jobs. The new TPI Composites facility in Newton, which opened last September and plans to employ 500 people, will play a critical role in driving the local economy, which previously suffered from the loss of 1,800 jobs at a nearby Maytag facility. The Newton facility was recently featured in the *New York Times* as an example of jobs emerging in the industrial heartland due to growing demand for wind turbine components.⁶

Iowa is both a compelling story about green-collar job growth—with 1,000 of these jobs added statewide in 2008⁷—and an example of the role that policy can play in attracting manufacturing by stimulating demand for renewable energy. Because the logistics costs of transporting blades, towers, and heavy wind equipment can account for 20 percent of the cost of a wind turbine, manufacturers prefer to locate facilities near demand. As a TPI employee pointed out in the *New York Times* article, "These are American jobs that are hard to

⁵ Based on GE internal data and Navigant Consulting, op. cit. note 2.

⁶ Peter S. Goodman, "A Splash of Green for the Rust Belt," *New York Times*, 1 November 2008.

⁷ Ibid.

export.”⁸ Thanks to this logistical reality, a strong wind resource, and supportive state policy, the Midwest has become a wind turbine manufacturing corridor, and Iowa—the first state to impose a renewable generation requirement on state investor-owned utilities—has become the hub of this corridor.

We are optimistic that the story of Newton and the example of Iowa will be seen as the beginning of the emergence of a substantial domestic US renewable energy manufacturing base. In the past two years, wind turbine and turbine component manufacturers announced, added or expanded 70 facilities—55 of these in 2008 alone.⁹ This facility growth can be largely attributed to the successive extensions of the Wind Production Tax Credit (PTC) in 2005 and 2006, which has given companies the confidence to invest in new manufacturing capacity. As a result, the US domestic content of wind turbine components—weakened by repeated PTC expirations in 1999, 2001, and 2003 and the accompanying drops in projects and manufacturing—is now trending upward. Between 2005 and 2008 GE more than doubled the number of turbines built in the US while increasing their US domestic content from 21 percent to 34 percent. We would expect this trend to continue if a long-term policy is established.

This need for a long-term policy has been magnified by the economic recession and financial crisis, which have rendered renewable energy tax credits ineffective. Last fall, there were 18 tax equity investors in the renewable energy market; today there are 4 active investors. This drying-up of project capital and resulting slowdown in orders for new wind and solar equipment have already caused several manufacturers and suppliers to announce layoffs or postpone their facility expansion plans. While Congress has taken commendable near-term steps to extend and modify these tax credit based policies in recognition of the current financial crisis, a long-term national commitment is now needed to provide industry with a longer time horizon for planning and runway for growth.

If Congress were to establish a Federal RES this year, GE would expect to see considerable growth in demand for its technologies. Responding

⁸ Ibid.

⁹ AWEA, op. cit. note 1.

to this growth would in turn prompt us to explore the expansion of existing wind turbine assembly facilities and addition of new facilities; increased commitments to component suppliers and the addition of new suppliers; and the acceleration of US-based solar production. These commitments would stimulate thousands of new jobs within GE and its suppliers. For example, with a stable, long-term federal policy in place, GE can foresee the significant expansion of current blade and drive train supplier facilities, and investments in 4-6 new tower manufacturing facilities. These investments could result in the creation of approximately 3,000-5,000 new jobs to support our wind business. In addition, we are aware of 10 to 12 foreign suppliers who have expressed a strong interest in opening facilities in the US, but are awaiting a long-term policy signal.

We estimate that a Federal RES along the lines of Chairman Markey's proposal could, along with existing policies, support 100,000 new jobs between the end of 2008 and the end of 2012, with even greater long-term potential. But GE, like the renewable energy industry in general, is simply unable to undertake this degree of long-term planning and large-scale capacity commitments in the absence of a sustainable renewable energy policy.

GE view on US renewable energy policy

To date, US renewable energy policy has consisted largely of a combination of federal tax incentives and state-by-state Renewable Portfolio Standards (RPS). Although the renewable industry has achieved record growth in recent years, this policy approach is unsustainable due to:

- The current financial crisis, which has exposed the weaknesses of a tax-driven approach to energy policy;
- The short-term nature of federal tax credits, which has led to boom-bust cycles and inhibited planning for long-term expansion of the manufacturing base;
- The complexity created by a patchwork of state RPS programs that vary widely in design and effectiveness; and

- The absence of a long-term national policy “signal” to project developers and technology providers that must compete in an increasingly global renewable energy industry.

We believe the US has an enormous opportunity to stimulate both immediate and long-term US-based jobs in manufacturing, projects, and services through a broad renewable energy policy that addresses three priorities:

- First, immediate reform of existing tax incentives to make them effective in the current economic climate;
- Second, a multi-year extension of these tax credits to provide a bridge for long-term policy; and
- Third, a sustainable long-term policy in the form of a Federal Renewable Electricity Standard.

We applaud the Congress for its leadership in addressing the first two of these three priorities in the recently enacted American Recovery and Reinvestment Act of 2009. We believe that the temporary Treasury grant program for project owners to access the benefits of the renewable energy investment tax credit, and the creation of a new Department of Energy loan guarantee program to facilitate debt financing of these projects, are essential steps toward realizing the Obama Administration’s goal of doubling renewable energy use by 2011. The implementation details are, of course, critical and we look forward to working with members of Congress and the Administration to maximize the effectiveness of these new programs.

We also applaud the Congress and the President for providing our industry with a medium-term “bridge” to sustained growth through the three-year extension of the Wind PTC. With wind and solar tax incentives now in place through 2012 and 2016, respectively, our industry now has a path to near-term recovery. But even with an immediate fix and medium-term bridge, the US still lacks a long-term policy framework for renewable energy.

GE view on a Federal RES

GE believes that a Federal Renewable Electricity Standard is needed to ensure US leadership in renewable energy and motivate the sustained development of a US renewable energy industry workforce. A well-designed Federal RES would provide a long-term policy signal to the industry, generating both near-term job growth in construction and services and long-term jobs in domestic manufacturing. A Federal RES is also an excellent example of the “complementary” policies that will be needed alongside a cap-and-trade program to maximize the contribution of renewable energy to greenhouse gas emission reduction goals.

State Renewable Portfolio Standards have proliferated over the past several years. In 2002, 12 states had a mandatory RPS. Today, 28 states and the District of Columbia have a mandatory RPS while another five have renewable energy goals. Last year alone, six states added or strengthened state RPS programs. Of the 31 states represented on the Energy and Commerce Committee, 19 have a state Renewable Portfolio Standard, three have a renewable energy goal, and two are considering a new RPS. Of the seven states that have installed over 1,000 MW of wind¹⁰, six of them—Texas, Iowa, California, Washington, Colorado, and Oregon—are represented in this committee.

GE believes that that state Renewable Portfolio Standards have had a significant impact on the near-term deployment of renewable energy. Last year over 85 percent of new wind capacity was added in a state with an RPS or renewable energy goal. And 63 percent of the wind turbine manufacturing facilities that were announced or came online in 2008 were in an RPS state. We estimate that current state RPS requirements represent over 50 GW of wind and over 10 GW of solar PV between 2009 and 2025.

These State RPS programs do not add up to a national commitment to renewable energy development and job creation, however. Relying solely on state programs, in fact, could actually cause wind and solar growth to plateau over the next decade. But State RPS programs have

¹⁰ AWEA, op. cit. note 1.

provided both a spur to near-term growth and valuable “lessons learned” to inform the design of an effective Federal RES.

Based on our engagement and experience with State RPS programs, we identify seven critical “design elements” of a Federal RES:

- First, an aggressive long-term goal (2020-25) to motivate long-term planning beyond business-as-usual
- Second, achievable interim goals (beginning in 2012) to stimulate near-term deployment
- Third, meaningful non-compliance “teeth” to motivate behavior
- Fourth, use of Renewable Energy Credit trading to promote least-cost compliance
- Fifth, support for distributed solar and other renewable generation through a credit multiplier
- Sixth, preservation of a renewables-only standard, separate from standards for energy efficiency or advanced energy
- Seventh, compatibility with state RPS activity so that states remain empowered to adopt consistent but stronger measures

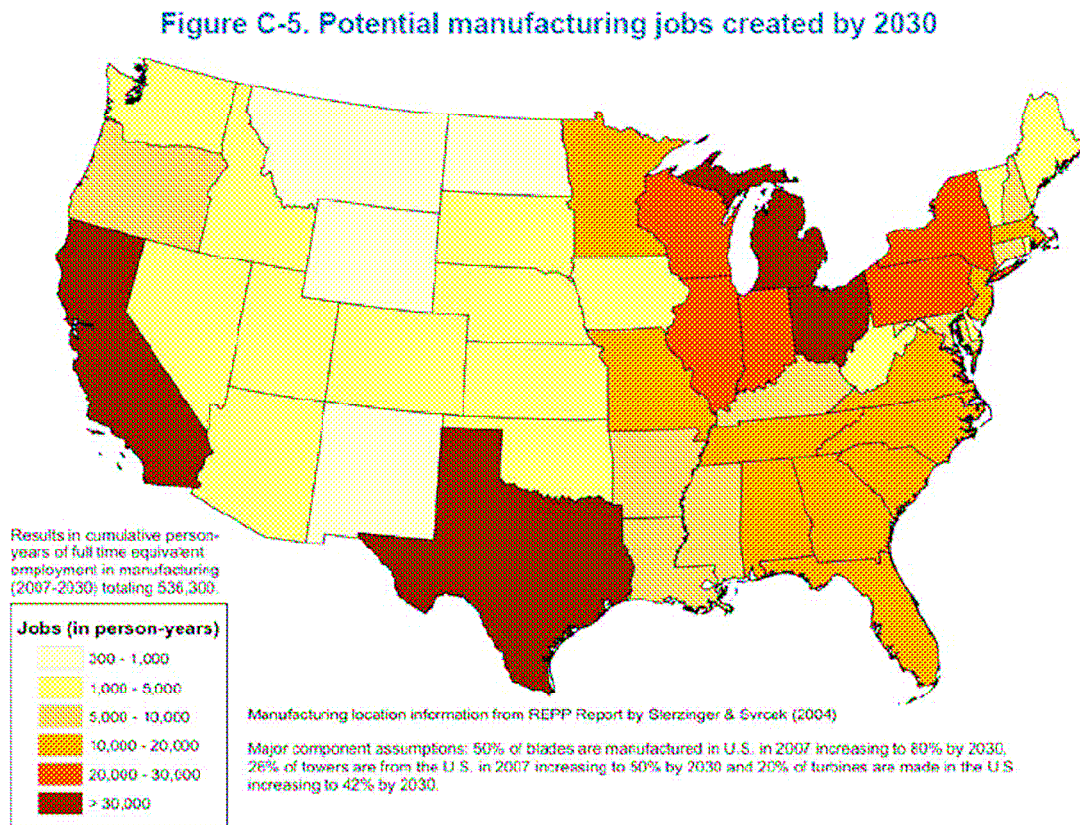
We note that Chairman Markey’s proposal, H.R. 890, reflects many of these design elements. As discussed below in further detail, however, separate legislation to expedite transmission expansion will also be essential to the success of a Federal RES.

Economic impacts of a Federal RES

The employment impacts of a Federal RES are likely to be substantial. In a 2008 study, the Department of Energy estimates that achieving 20 percent wind by 2030 would result in an installed base of more than 300 gigawatts of wind. This scenario would support 500,000 jobs in manufacturing, construction, operations, and related sectors. Many of the manufacturing jobs are in states that have recently experienced significant job losses, but “even states without a significant wind resource can be impacted economically from new manufacturing jobs (e.g. southeastern US).” (See Figure 1.)¹¹

¹¹ Data and Figure 1 from US DOE, *20% Wind Energy by 2030: Increasing Wind Energy's Contribution to US Electricity Supply*, July 2008.

Figure 1:
Potential wind manufacturing job impact of 20% wind scenario (2030)

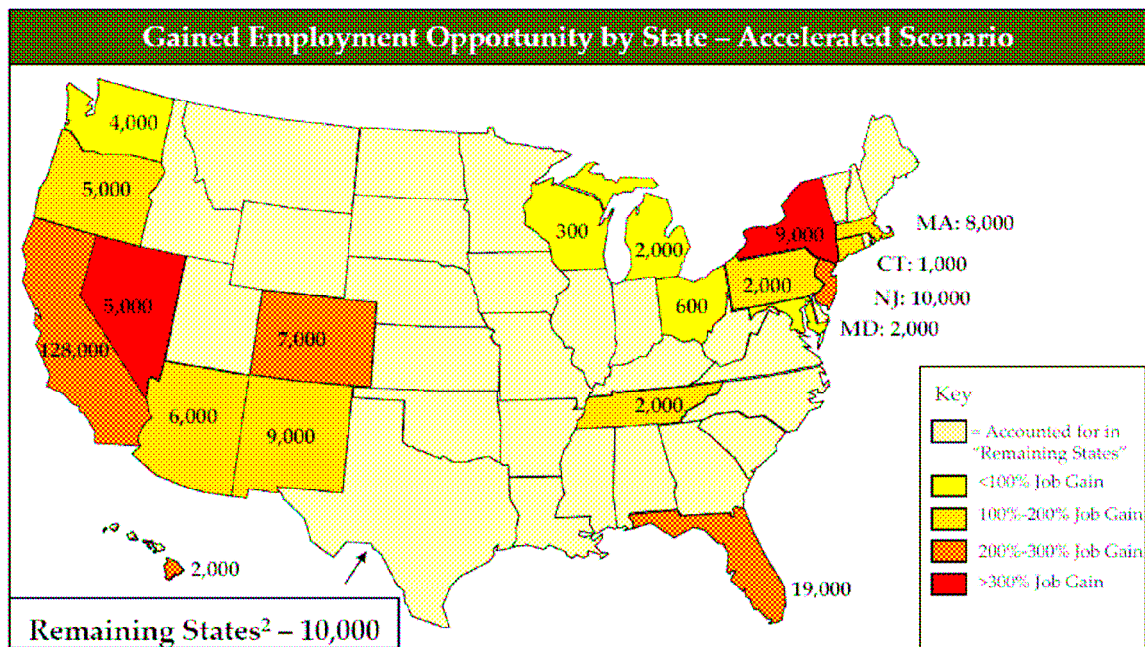


Source: US DOE 2008. Used with permission.

Similarly, the solar PV industry could support the installation of more than 22 gigawatts and 230,000 new jobs by 2016 under an “accelerated” policy scenario, according to a report from Navigant Consulting.¹² Here, too, job growth is not limited to regions with a strong solar resource, as demonstrated by the employment potential in the Pacific Northwest and Northeast. (See Figure 2.) While these studies do not look explicitly at the job creation impacts of a Federal RES, and they do not include other renewable energy sources such as concentrated solar thermal or biomass, they provide an indication of the industry’s job creation potential under a Federal RES.

¹² Data and Figure 2 from Navigant Consulting, op. cit. note 4.

Figure 2:
Potential solar PV job impact of accelerated policy scenario (2016)



Source: Navigant 2008. Used with permission.

Opponents of a Federal RES argue that not all states have adequate renewable energy resources to meet potential RES requirements. The answer to this, we believe, is assuring the eligibility of a range of resources. For example, North Carolina's RPS has established special supports for solar PV and biomass resources such as swine and poultry waste. According to a Navigant Consulting report prepared for the state of Florida and the Lawrence Berkeley National Laboratory, the state has adequate renewable resource potential—including solar energy and biomass sources such as agriculture and forestry residues and energy crops—to provide as much as 18 gigawatts of capacity or 27 percent of utility retail sales by 2020.¹³

Federal RES critics point to the potential cost impact, particularly the effect on electricity customers. To date, however, the price impacts of state RPS programs have been modest. According to the National Renewable Energy Laboratory, state RPS policies contributed to rate increases of 1 percent or less in 2007—a number that is biased upward

¹³ Navigant Consulting, *Florida Renewable Energy Potential Assessment*, Prepared for Florida Public Service Commission, Florida Governor's Energy Office, and Lawrence Berkeley National Laboratory, 24 November 2008.

as it ignores the potential role of renewable energy in reducing natural gas and wholesale electricity prices.¹⁴ According to a 2007 study from the Energy Information Administration, a Federal RES of 25% by 2025 would lower natural gas expenditures by 1%, for a total reduction of \$17 billion. These savings more than offset the increase in electricity prices of 0.4%, which increases expenditures by \$15 billion, leading to a net consumer savings of \$2 billion.¹⁵

Interaction with climate legislation

Discussion of the costs and benefits of a Federal RES must also be considered in the context of greenhouse gas emission reduction. GE is a member of the US Climate Action Partnership, an alliance of 30 businesses and environmental groups that supports an economy-wide, market-driven approach to climate change that includes a cap-and-trade program as a core element. In a set of consensus recommendations released in January, US CAP members state that

*... policies and measures that are complementary to a cap-and-trade program are needed to create incentives for rapid technology transformation and to ensure actual reductions in emissions occur ... where market barriers and imperfections may prevent the price signal from achieving significant reductions in emissions within those sectors.*¹⁶

In our view, a Federal RES is an excellent example of the complementary policies needed to provide incentives for continued technological improvement and near-term emission reductions. Along with energy efficiency, renewable energy is widely viewed as one of the most promising near-term climate stabilization “wedges.” The DOE’s 20 percent wind scenario, for example, would reduce cumulative emissions of over 7,600 million metric tons of CO₂ by 2030 and over 15,000 million tons of CO₂ by 2050. This would nearly level projected

¹⁴ Ryan Wiser and Galen Barbose, *Renewables Portfolio Standards in the United States*, Lawrence Berkeley National Laboratory, April 2008.

¹⁵ Energy Information Administration (EIA), *Energy and Economic Impacts of Implementing Both a 25-Percent Renewable Portfolio Standard and a 25-Percent Renewable Fuel Standard by 2020*, August 2007.

¹⁶ US Climate Action Partnership (US CAP), *A Blueprint for Legislative Action: Consensus Recommendations for US Climate Protection Legislation*, January 2009.

growth in CO₂ emissions from the electricity sector.¹⁷ A Federal RES, by accelerating the near-term deployment of wind and other renewable energy, is thus a sensible down payment on future climate legislation.

Transmission and siting challenges

Two additional challenges confronting the long-term growth of the US renewable energy industry are transmission and siting. Some of our best indigenous renewable energy resources exist in remote locations and require new, long-distance transmission lines to be accessed. The long-term goals of a Federal RES simply cannot be met without a concerted national commitment to new transmission infrastructure analogous to our nation's investment in an interstate highway system. As noted in a recently-released White Paper on "Green Power Superhighways"¹⁸ developed jointly by AWEA and SEIA, many of the barriers to transmission expansion to access renewable energy are not technical but policy-related. Key recommended policy solutions fall into three areas:

- Interconnection-wide transmission planning, specifically the development of regional transmission plans by the Western and Eastern Connection;
- Interconnection-wide cost allocation and certainty for cost recovery, specifically the regional development and federal approval of plans that allocate costs across all load-serving entities on an interconnection-wide basis; and
- Federal siting authority, specifically FERC approval and permitting for specific extra-high-voltage facilities defined in the regional plans as needed to meet renewable energy goals.

Our industry must also continue to work with environmental groups and government agencies to ensure that future renewable energy transmission and generation projects are planned and sited in an environmentally-sound manner. One major need in this regard is better scientific understanding of the potential impacts of future projects. As one step in this direction, GE recently became a founding

¹⁷ US DOE, op. cit. note 11.

¹⁸ AWEA and SEIA, *Green Power Superhighways: Building a Path to America's Clean Energy Future*, February 2009.

member of the American Wind Wildlife Institute. This Institute, on whose Board I serve, is an industry-NGO science-based collaborative aimed at facilitating the timely and responsible development of wind energy while protecting wildlife and wildlife habitat through research, mapping, mitigation, and public education on best practices on wind farm siting and habitat protection.¹⁹

The global challenge

Adoption of a Federal RES will do much to help the US catch up with Europe in renewable energy manufacturing and job creation. GE is presently the only major domestic US wind manufacturer, with European companies accounting for the majority of the remaining industry leaders. This European manufacturing advantage can be traced to a long-term stable European policy environment, which is based on the region's early recognition of the job creation potential of the renewable energy industry and the importance of creating strong domestic markets to develop this industry.

Since the 1990s, Europe—led by Denmark, Germany, and Spain—has made substantial long-term commitments to wind through predictable, stable feed-in tariffs—lasting up to 20 years—that stimulated demand for renewables and allowed their domestic manufacturers to grow to meet this demand. Over time, wind penetration grew and companies expanded and began to export. Today, wind power's share of electricity is 19 percent of electricity in Denmark, 10 percent in Spain, and 6 percent in Germany. Danish, Spanish and German firms figure prominently among leading wind manufacturers and developers.

According to the German Wind Energy Association (BWE), the German wind industry directly employs more than 100,000 people—as a share of national population, more than four times the US total. In 2007 it accounted for 37 percent of global wind turbine and component manufacturing and generated 6 billion Euros in exports in 2007, making it the nation's second leading export industry after automobiles. The key to this industrial success is domestic policy; as the BWE states, “a

¹⁹ American Wind Wildlife Institute, “20 Leading Environmental, Conservation & Wind Energy Groups Launch New Institute,” press release, 19 November 2008.

stable domestic market is of the utmost importance” for creating industry jobs and exports.²⁰

The European Union is now stepping up its regional commitment to renewables, recently adopting a Directive of 20 percent renewable energy by 2020. This binding directive is expected to result in yet another wave of feed-in tariffs, market stimulation, job growth and exports. The EU is also repeating its policy success in wind with solar power; Europe leads the global solar PV market and is developing a regional solar manufacturing base.

Other countries are following Europe’s lead. Remarkably, over 65 countries worldwide now have national targets for renewable energy²¹—but the United States is not among them. Many of these countries have major aspirations for deploying renewable energy as a source of industry development and job growth.

No country exemplifies grand renewable energy ambitions more than China, which publicly aims to become a global hub for wind turbine manufacturing. This past December the Chinese government tripled its national goal for wind from 30 GW to 100 GW by 2020. The country is currently projected to surpass the US in annual wind installations as early as 2010. An important driver of this growth is a national “Mandated Market Share” policy, which requires power generators and grid operators to devote a growing percentage of their power to renewable energy source. In effect, China has already adopted a policy similar to a Federal RES.

This accelerating global political momentum toward renewable energy means that a national commitment is no longer an option but a necessity if the US seeks a leadership position in the industry. As I stated at the beginning of my testimony, GE believes that a Federal RES is the single most important step that Congress can take to lay the long-term foundation for a sustained green-collar workforce and a domestic renewable energy manufacturing base. And by accelerating

²⁰ German Wind Energy Association (BWE), “Wind Energy in Germany,” <http://www.wind-energie.de/en/wind-energy-in-germany/>.

²¹ Based on REN 21, *Renewables 2007 Global Status Report*, February 2008 and REN 21, “WIREC 2008 Pledges,” <http://ren21.net/wiap/wirec.asp>.

the near-term deployment of commercially available technologies to reduce greenhouse gas emissions, a Federal RES will serve as a critical complement to future climate change legislation.

Thank you for holding this important hearing, and for the opportunity to present this testimony. I look forward to your questions.